The occurrence of the criniod Uintacrinus in Australia by Thomas H. Withers, F.G.S., *Communicated by* L. Glauert.

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Much credit is due to Mr. Glauert, of the Western Australian Museum, Perth, for his continued interest in the fossils of the Gingin "chalk," for it has resulted in the finding of the remains of the unstalked crinoid *Uintacrinus*. Soon after the publication of my paper on the only known Australian Cretaceous Cirripede *Calantica (Scillaclepas) gingincnsis* (R. Etheridge, jnr.), (1924, Journ. Roy. Soc. W. Austr., vol. ix., pt. ii, p. 64, pl. i), Mr. Glauert sent me, at my request, some "chalk" from Gingin so that it could be washed for additional valves of that Cirripede. The results were not particularly successful so far as Cirripedes were concerned, but two Crinoid plates were found which, although not at all well preserved, seemed to me to represent the cup-plates of *Uintacrinus*. This, combined with the fact that Etheridge (1913, Bull. 55, Geol. Surv. W. Austr., p. 11) mentioned "disarticulated Crinoid plates, and arm-ossicles" among the Echinoderms recorded, induced me to send to Mr. Glauert some drawings of plates of *Uintacrinus*, with the request to send me any similar plates that he had. In response he not only sent me, through the kind offices of Mr. C. L. Egremont Orton, of Moora, W. Australia, some plates of that Crinoid, but he also took the trouble to send some additional "chalk" to wash. This last proved very interesting, for from it were obtained some further cup-plates, which conclusively proved that they were *Uintacrinus* plates, but as in Mr. Glauert's material, furnished also examples of arm-ossicles.

Shortly afterwards Mr. G. Spencer Compton asked me to examine a suite of fossils which he had collected from the Gingin deposit, and had brought to England with him, and this included some further undoubted cup-plates of *Uintacrinus*.

Uintacrinus is not only one of the most easily recognisable of the fossils of the English Chalk, but it is one of the most useful. Its importance lies in the fact that it is confined to a definite and restricted horizon, the *Uintacrinus*-band, which forms the lower part of the *Marsupites* zone of the Senonian. Except in rare instances, *Uintacrinus* is represented only by the disconnected cup-plates and arm-ossicles (brachials), and since these occur quite commonly and often outnumber the associated fossils, they are readily found on weathered surfaces or by breaking up blocks of chalk.

Uintacrinus (*U. socialis* Grinnell) was first found* in the

* 1871. Marsh, O. C. "On the Geology of the Eastern Uintah Mountains: Amer. Journ. Sci., ser. 3, vol. i, p. 195.

Uintah Mountains, in north-eastern Utah, but was described †‡on better preserved material from Trigo Co., Kansas. Almost immediately afterwards **Uintacrinus* (*U. westphalicus* Schlueter) was found in the Senonian of Recklinghausen, Westphalia. Its occurrence in the English Chalk was recognised by Dr. F. A. Bather from material submitted by Dr. A. W. Rowe and C. D. Sherborn (see Bather, F. A., 1896, "The Search for *Uintacrinus* in England and Westphalia," Geol. Mag., dec. iv., vol. iii. pp. 443-445). It occurs quite commonly in the Marlstone of Westphalia, and since its recognition by Dr. Bather it has been proved by Rowe and Sherborn, and other chalk workers, to be one of the most useful guide fossils of the English chalk. A more detailed study of the morphology of the Kansas form has been made by Dr. Bather (vol. 1895, Proc. Zool. Soc., London, pp. 974-1004, pls. liv.-lvi., April, 1896), and a good figure drawn under his direction, has been given of some associated plates from Margate (here reproduced, pl. iii, fig. i) in Rowe and Sherborn (1900, "The Zones of the White Chalk of the English Coast, Pt. I., Kent and Sussex," Proc. Geol. Assoc. London, vol. xvi., pt 6, p. 298). Its wide distribution in America is evidenced by its being found in Utah and Kansas at localities over five hundred miles apart. Upwards of twelve hundred specimens of *U. socialis* from the Niobrara Chalk of Kansas were collected by F. Springer (1901, "*Uintacrinus*: its Structure and Relations": Mem. Mus. Comp. Zool. Harvard, vol. xxv., No. 1), in which more or less of the calyx is visible, and a single slab measuring 8ft. by 4ft. contains about one hundred and twenty-five specimens, many of them with long arms and finely preserved.

That *Uintacrinus* should now be found in the deposit at Gingin, W. Australia, is therefore of very great interest, and lends point to the view expressed by Dr. Bather (1896, Geol. Mag., p. 444) when noting its occurrence in the *Marsupites*-zone of Westphalia and England, that it occurs "probably at the same horizon in a good many other countries."

The Gingin specimens consist of nine detached cup-plates and 13 arm-ossicles (brachials), and although R. Etheridge, jnr. (1913), must have had other specimens, there is no evidence as yet that the plates occur commonly. No plates of the unstalked Crinoid *Marsupites* have been found with them, but it may be that there is not a sufficient thickness of the deposit to allow of its occurrence in the beds above, although in the English chalk it is occasionally found associated with the plates of *Uintacrinus*. There is also no evidence of the occurrence of the stalked Crinoid *Bourgueticrinus*. The cup-plates of *Uintacrinus* have their outer

† 1876. Grinnell, G. B. "On a new Crinoid from the Cretaceous Formation of the West": Amer. Journ. Sci., ser 3, vol. xii, pp. 81-83.

‡1876. Meek, F. B. "Note on the new genus *Uintacrinus* Grinnell": Bull. U.S. Geol. & Geog. Sur., vol. ii. pp. 375-378.

* 1878. C. Schlueter, "Ueber einige astylide Crinoiden" Zeitschr. deutsch. geol. Ges., Bd. xxx, pp 28-66, pls. i-iv. "iii. **Uintacrinus Westphalicus**, ein ungestielter tesselater Crinoid aus dem Senon Norddeutschlands," pp. 55-63, pl. iv, figs. 1-5.

surface smooth, they are flattish and not very thick, and usually of a pentagonal or tetragonal outline. On their inner surface they are usually very characteristic, for the presence of wide V-shaped grooves (pl. iii, figs. 2, 3, 4), radiating from the centre to the sides, not to the angles, allows of their ready indentification. These peculiar grooves are for the passage of muscles and nerves connecting the arm-plates. The arm-ossicles (brachials) are often characterised by a diagonal fulcral ridge (pl. iii, figs. 7, 8), but in others there are a number of weak ridges radiating from the periphery to the axial canal (pl. iii, figs. 9, 10).

Some uncertainty still remains as to whether the Westphalian form (*U. westphalicus*) and the English form (*U. sp.*) of *Uintacrinus* represent a single species, and if so whether this is identical with the Kansas form (*U. socialis*). F. Springer (1901, p. 87) is of the opinion that the American and European forms represent a single widely distributed species, which, of course, must bear the name *U. socialis* Grinnell. The Gingin material is insufficient to throw any light on this subject, but the resemblance of the radial plate (pl. iii, figs. 4a, b), from Gingin, to a radial plate (pl. iii, figs. 3a, b) from Keston, Kent, is unmistakable. In any case the discovery of these Gingin plates is an important addition to the geographical distribution of *Uintacrinus*.

Age of the Gingin Deposit.

The early history of the Gingin deposit is given in a paper by L. Glauert (1910, Geol. Surv. W. Austr., Bull. No. 36, pp. 115-127; see also A. Gibb Maitland and A. Montgomery, 1912, Bull. No. 50, p. 22), where he gives a preliminary account of some of the fossils. In this paper full references are given to previous writers. Mr. Glauert insisted on the Cretaceous age of the beds, although R. Etheridge, jnr. (see A. Gibb Maitland, 1907, Geol. Surv., W. Austr., Bull. No. 27, p. 38) tentatively suggested an Upper Tertiary age for the deposit. Later R. Etheridge, jnr. (1913, Geol. Surv. W. Austr., Bull. No. 55, IV., Palaeont. Contrib. to The Geology of Western Australia, pp. 1-34, pls. I.-IV.), described the fossils of the Gingin deposit, and suggested the beds were of Upper Cretaceous age. F. Chapman (1917, Geol. Surv. W. Austr., Bull. No. 72, Palaeont. Contrib. to The Geol. W. Austr., "Monogr of the Foraminifera and Ostracoda of the Gingin chalk"), basing his opinion on the Foraminifera, states (p. 15): "On the whole, however, the fauna is decidedly of Albian *cum* Cenomanian relationship, and not of Aptian or Lower Cretaceous." Of the Ostracoda he states (p. 52): "The balance of evidence from the Ostracoda is therefore clearly in favour of a correlation with the lower part of the Upper Cretaceous, that is Albian."

L. Glauert (1923, Journ. Roy. Soc., W. Austr., vol. ix., pt. 1., p. 48) subsequently described from these beds an Echinoid, *Cidaris comptoni*, which represents the first known Australian Cretaceous species of Echinoidea, but he did not discuss further the age of the Gingin deposit.

In my paper on the Cirripede *Calantica* (*Scillaelepas*) *gin-*

ginensis (R. Etheridge, jnr.), (1924, Journ. Roy. Soc. W. Austr., vol. ix., pt. ii., p. 66) the horizon was not only given as Upper Cretaceous, but I ventured to put "(?Upper Senonian.)" This opinion was not so much based on the occurrence of the Cirripede, but the associated fossils seemed to me to suggest an Upper as opposed to a Lower Senonian age for the beds.

The discovery of such a fossil as *Uintacrinus*, marking as it does in Europe a definite horizon in the Senonian, namely the *Marsupites*-zone, which forms the upper part of the Santonian or middle division of the Senonian,* seems to place the Santonian age of the Gingin deposit beyond doubt. Whether it is exactly equivalent to the *Marsupites*-zone of the European Cretaceous is a question that cannot be settled until the associated fossils have been studied in more detail. In such a distant geographical area, there is a possibility that *Uintacrinus* might occur a little lower or a little higher in the sequence, although still within the limits of the Santonian or middle division of the Senonian.

In conclusion I wish to express my thanks to Mr. L. Glauert for the very great trouble he has taken to supply me with material. I have also to thank Mr. G. Spencer Compton for kindly adding to this, and with his name should be associated that of Mr. C. O. A. Thomas, who has collected so intensively in the deposit at Gingin.

EXPLANATION OF PLATE III.

Uintacrinus socialis Grinnell.

1. Nearly complete specimen from the Niobrara Chalk of Kansas, U.S.A. Natural size. (Reproduced from F. Springer, 1901, pl. v., fig. 2).

Uintacrinus sp.

2. Several plates in the natural position; natural size. C, centrale; B, basals; R, radials; IBr_1, first primibrach; IAx, primaxil=second primibrach; $IIBr_1$, first secundibrach; iBr, interbrachials. The detached plate is a radial, from Westgate, viewed on the inner surface. Coll. A. W. Rowe. Gilbert C. Chubb, del.; F. A Bather, dir. (after F. A. Bather in Rowe).
3. Cup-plate (radial) from Keston, Kent: a, outer view; b, inner view, × 2. Brit. Mus., E. 24935.

Uintacrinus sp.

Middle Senonian (Santonian): Gingin, Australia.

4. Cup-plate (radial): a, outer view; b, inner view. × 4. Brit. Mus., E., 24939.
5. Cup-plate. × 2. G. Spencer Compton coll., Brit. Mus., E. 24936.
6. Cup-plate. × 4. G. Spencer Compton coll., Brit. Mus., E. 24937.
7. Articular or joint surface of a normal brachial. × 4. Brit. Mus., E. 24940.
8. Same. × 4. W. Austr. Mus.
9. Joint surface of a syzygial brachial. × 4. Brit. Mus., E. 24941.
10. Same. × 4. W. Austr. Mus.

*In Lang, W. D., 1921, Brit. Mus. Cat. Cretac. Bryozoa, Vol. 3, pl. XVIII.

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